DOCUMENT RESUME

ED 340 524 RC 018 220

AUTHOR Daniels, Roberta R.; Lamb, Julie K.
TITLE Changing Gifted Girls' Attitudes toward Mathematics.
PUB DATE Mar 90
NOTE 13p.; Paper presented at the Rural Education Symposium of the American Council on Rural Special Education and the National Rural Small Schools Consortium (Tucson, AZ, March 18-22, 1990).
PUB TYPE Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academically Gifted; *Attitude Change; Attitude Measures; Career Awareness; *Females; Intermediate Grades; *Intervention; Junior High Schools; *Mathematics Anxiety; *Mathematics Curriculum; Pretests Posttests; Problem Solving; Rural Areas; Student Attitudes

ABSTRACT

The purpose of this study was to determine if an intervention program improved gifted girls' attitudes toward mathematics. Forty-eight academically gifted girls in grades 4-7 were selected from an isolated, rural area of the Mid-South. In the pre-test, both experimental and control groups were administered the Mathematics Attitude Inventory (MAI). There were no significant differences between the groups concerning attitudes toward mathematics. The intervention program presented to the 24 girls in the experimental group consisted of 8 units containing both individual and group activities. Unit 1 consisted of five activities to enhance self-esteem. Unit 2 contained activities to develop positive attitudes about mathematics. Unit 3 dealt with problem-solving skills. Unit 4 encouraged the girls and other students to be involved in mathematics outside class requirements. Unit 5 consisted of exploring careers related to mathematics. In unit 6 the girls again involved classmates in math projects. Unit 7 reinforced problem solving strategies from unit 3 and introduced new problem solving techniques. Unit 8 was for review and evaluation. The gifted girls in grades 4, 5, and 6 met daily for 30-45 minutes for 18 weeks, and girls in grade 7 met 2 days per week for 1 hour. The MAI was readministered at the end of the program to compare aptitudes between the experimental and control group. The experimental group had a higher average score in mathematic aptitude than the control group and the difference was statistically significant. (LP)

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Roberta R. Daniels, Ph.D.
Professor of Gifted and Talented
Arkansas State University
State University, AR 72467

Julie K. Lamb, M.S.E.
Teacher of the Gifted
Northeast Arkansas School District
Paragould, AR 72450

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Paper prepared for 10th annual NR SSC/ ACRES Conference in Tucson, Arizona. March 18-23, 1990.

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Improving Gifted Girls' Attitudes Toward Mathematics

In our ever changing world of technology and problems, the increased demand of competency in mathematics is evident. Math is an intricate part of the society in which we live. In 1981 Adams and Dutton noted that math was the "cornerstone of technology". Indeed we use math skills in almost every activity of our daily lives; how much water to add to other ingredients, the cost of fuel or clothing, paying for medical care for people or pets, prices for varied entertainment activities, and most certainly the cost of eating and operating our local and national government. Therefore, math education is a critical factor in the technical world.

Researchers (Armstrong, 1979; Boswell & Katz,1980; Fennema & Sherman,1977; Fox,1980) have noted for a number of years that there are educational and career barriers between females and the field of mathematics. Boswell and Katz (1980) indicated that most females that they studied did not have the appropriate math background to enter technical fields of study in college due to a deficiency in the number of courses taken in mathematics during high school.

Sex differences in aptitude, achievement, and problem solving skills were researched by Fennema and Sherman (1977) at both junior and senior high school levels. They discerned that most males completed three or four years of high school mathematics while females completed one or two years of math classes. When comparing males and females that had taken the same number of math classes Fennema and Sherman (1977) found that the males did in fact outperform the females in math achievement. They noted that there were great differences in attitudes toward math even though the same amount of math had been taken. It has been concluded that positive attitudes toward mathematics are a key factor in sex differences relative to success in math related

endeavors according to Armstrong (1979) and Boswell and Katz (1980).

In a 1984 study Fleming and Hollinger examined internal barriers in existence for gifted girls relative to mathematics. These barriers include (1) an avoidance of math because it is not feminine; (2) exhibiting a lack of ability in math due to lack of assertion; (3) success avoidance; (4) social expectations. Fleming and Hollinger (1984) then asserted that a variety of internal factors affect females' decisions to avoid mathematically related activities. It has also been noted that gifted females limit their career choices in technical fields due to a lack of positive attitudes toward mathematics (Armstrong, 1979; Fox,1980; Wise, Steel,& McDonald,1979). Indications from those authors are that the females' attitudes toward mathematics begin to be less positive around age 13. In a later study (Lytle,1987), females' lack of positive attitude has been attributed to stereotyping rather than a lack of ability. The stereotyping was attributed to not only the females themselves, but to parents, teachers and peers.

It is crucial that gifted girls receive instruction that will deter or eliminate the negative attitudes they have toward mathematics. It is not too early to begin such instruction at the elementary level.

The purpose of this study was to determine if an intervention program designed to improve gifted girls' attitudes toward mathematics did in fact improve attitudes toward mathematics. Forty-eight identified as academically gifted girls from isolated rural schools in the Mid-South ranging from fourth to seventh grade participated in this study. The girls were equally divided into experimental and control group subjects.

All 48 gifted girls were tested with the Mathematics Attitude Inventory (MAI) (Sandman, 1979) which is a 48 item self-rating scale. The MAI was designed to determine group attitudes toward math and to assess possible changes in attitude. Following parental permission to assess the attitudes of the gifted girls the MAI was administered to all 48 students. A statistical analysis utilizing the t-test revealed that there were no significant differences between the experimental and control group scores on the MAI (Sandman, 1979).

The intervention program presented to the 24 gifted girls in the experimental group involved attitude and career awareness activities based upon Just Around the Corner (Roberts, 1982) and Math for Girls and Other Problem Solvers (Downie, Slesnick, & Stenmark,1981). The gifted girls developed problem solving strategies according to Problem of the Week (Fisher & Medigovich, 1981) and Mental Math in the Middle Grades (Hope, Reys, & Reys, 1987). These materials contain both individual and group activities dealing with attitudes about mathematical decisions, career information in the area of mathematics, and problem solving strategies. Activities for the experimental group, grades 4-7 were grouped according to units taking approximately one to two weeks to complete. Most activities were done together during classtime, although some were outside of school activities. These outside class activities took approximately 30 minutes each to complete. Class discussion followed the outside class assignments for clarification. The gifted girls in grades 4, 5, and 6 met daily for 30 to 45 minutes for 18 weeks to participate in the intervention program. The seventh grade gifted girls met two days per week for one hour during the semester to receive the programming.

Unit one consisted of five activities to enhance self-esteem. Unit two contained activities to develop positive attitudes about mathematics. Unit three dealt with problem solving skills. In unit four, the students encouraged other students to be involved in mathematics outside class requirements. Unit five informed the students concerning careers related to mathematics. In unit six the 24 gifted girls again involved classmates in math projects. Unit seven reinforced problem solving strategies from unit three and introduced new problem solving techniques. Unit eight was for review and evaluation.

Activities for unit one pertaining to self-esteem as formulated by Roberts (1982) were completed in three weeks. The first activity entailed making a list of "Things I Do Well" and a list of "Things I Don't Do Well." The gifted girls were instructed to make a list of ways to improve the things they did not feel confident doing. In activity two, the same girls wrote a paper containing things they liked about themselves. These qualities were discussed at the girls' initiative. Activity three in unit one was provided to make the gifted girls more aware of optimistic and pessimistic attitudes. Optimism and pessimism were discussed and role playing was used to demonstrate the two attitudes following the discussion. Activity four in unit one dealt with self-perception relative to task commitment. The 24 subjects discussed the meaning of responsibility, listed tasks they were responsible for at home, and listed how their efficiency at the tasks benefitted their families. The last activity for

unit one consisted of preparing a collage using any media to display different attitudes. The girls then evaluated the unit by completing a questionnaire which reflected attitudes about good and poor attitudes.

Unit two pertaining to math attitudes, also devised by Roberts (1982), consisted of four activities to develop an appreciation for mathematics. This second unit took two weeks to complete with the gifted girls in the experimental group. The first activity was a "Math Appreciation Day." The girls were responsible for making positive comments about math throughout the day. Posters and pins were made announcing that "Math is Great". The experimental group grades 4, 5, and 6 also organized a "Math Club for Girls" and encouraged anyone interested in promoting math to join. The math club met once a week at recess to discuss math projects and encourage each other with math assignments. The seventh grade did not participate in the math club activity because they did not have recess. Activity two of unit two required the gifted girls to list people that dealt directly with mathematical processes in their daily lives. They also listed attitudes these people must posses toward math. Activity three required the girls to examine the usefulness of mathematical knowledge relative to a particular industry in the community. The girls called the general office of the businesses and asked how the company benefitted from or used mathematical processes. Activity four of unit two required the girls to probe into how money and mathematics coincided by doing a budget for their family.

Unit three related to problem solving and was designed to improve problem solving abilities according to Fisher and Medigovich (1981). One problem was explored and completed during a three week period. Students developed an imaginary monetary system and the proposed rates of exchange. Discussions followed about other possible rate exchanges with different imaginary countries.

Unit four relative to math involving others was used to make the gifted girls leaders in a mathematical project. The girls developed a math newspaper entitled Math Rap for the school. They created math games, puzzles, comics, and news for the upper elementary students. The math newspapers were distributed to the fourth through seventh grades in the school where the girls comprising the experimental group attended. This unit took about two weeks to complete.

Unit five concerning occupations in math dealt with occupations in mathematically related fields. Activity one was to research and list all the math-related occupations that could be located. Resources were made available with the assistance of the school librarian, counselor, and a variety of community workers. In activity two of unit five, math-related occupations were matched with clues about the occupation. Activity three was role playing math-related occupations based upon materials by Hope, Reys, and Reys (1987). Unit five was completed during a two week period.

While participating in Unit six dealing with helping others with math, the gifted girls provided a tutoring service for a variety of students. The 24 gifted girls provided assistance at recess or visited the regular classrooms if any of the teachers so designated. The gifted girls were available to tutor students for one week.

Unit seven concentrated on problem solving strategies to reinforce skills learned in unit three. Students were given one problem per week for two consecutive weeks provided by Fisher and Medigovich (1981).

Unit eight was for review, to discuss and evaluate progress of the gifted girls relative to attitudes toward math. During activity one of unit eight, discussion were conducted about the usefulness of math in our society. For activity two of unit eight, the girls listed all the activities they had participated in that related to math. As the activities were listed, they stated the benefit of the activities and ways to improve or do them differently. Activity three of unit eight was the administration of the MAI by Sandmen (1979) to render posttest results.

Results

Statistically significant difference in math attitudes of gifted girls were found between the experimental and control groups for the posttest scores. The significant t-score is presented in Table 1.

Insert Table 1 about Here

Based on the results of the statistical analysis of the posttest scores it was concluded that the intervention program designed to improve the math attitudes of gifted females did make a significant difference in 24 gifted girls' math attitudes in an isolated rural setting as measured by the MAI (Sandman, 1979).

A number of researchers in the past (Armstrong, 1979; Boswell & Katz,1980; Fox, 1980) reported that sex differences in mathematics achievement were not due to ability but some attitudinal factors. Armstrong (1979) asserted that stereotypical expectations placed on girls by parents, teachers, and peers relative to math involvement was the most influential factor effecting math achievement for girls. Whereas, Fox (1980) noted that the detriment to gifted girls as it related to math was because of a lack of participation in math. If these contentions are true, then this study indicates the math attitudes of gifted females can be influenced.

Further research needs to be conducted on populations in other isolated rural or urban areas by replicating this study. The gains made by the experimental group are very likely due to the variety and extent of activities provided in the intervention program. Another factor that can't be statistically supported by this study, but had a possible effect on the findings, deals with the researcher being a female role model. Thus, more research needs to be considered concerning female role models' affect on gifted girls' math attitudes. Instruments to compare individual math attitudes and including questions about the affects of a female role model should be devised to further the existing body of knowledge relative to gifted females' math attitudes. In addition, studies of this nature need to be replicated as Schmid recommended in 1980 to utilize more experimental and control groups.

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Table 1

Gifted Girls' Mathematical Attitudes

Posttest Scores of Experimental and Control Groups

Groups	N	Mean Scores	Standard Deviations	t
Experimental	24	170.25	13.62	
				5.92*
Control	24	139.17	22.01	

*Significant at the .05 level

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